REMARKS

Claims 39-42 have been canceled. Thus, claims 1, 16-26 and 35-38 are pending. Applicant submits amendments and arguments for overcoming the rejections based on the prior art of record. Accordingly, Applicant respectfully submits that the present application is in condition for allowance.

I. Claim Rejections – 35 USC §103(a)

A. In the FINAL Office Action dated January 23, 2009, claims 1, 16-25, 35-37 and 39-41are rejected under §103(a) as being obvious over JP 01-096374 A or JP 01-180976 A.

Independent claim 39 of the present application has been canceled. The remaining independent claims of the present application, claims 1 and 35, have been amended such that each requires a copper alloy sputtering target containing 0.01 to less than 0.5wt% of Al (aluminum). Dependent claims 16 and 37 have been amended to further limit the aluminum content to 0.05 to 0.2wt%. No new matter was added; these claims previously required the claimed content to be of Al and/or Sn and have now been limited strictly to Al. See Examples 1-5 listed in Table 1 on page 11 of the present application, as filed.

The composition disclosed by each of JP '374 and JP '976 does not contain the above required amount of aluminum. For at least this reason, Applicant respectfully submits that the claims of the present application are non-obvious and patentable over JP '374 and JP '976. However, this is not the only reason why the present invention as claimed would not be obvious to one of ordinary skill in the art based merely on the teachings of JP '374 and JP '976. Additional reasons are discussed below in greater detail.

(i) The Disclosure Provided by JP 01-096374 A

JP '374 discloses a sputtering target assembly including: (i) a copper sputtering target (1) having an exposed sputtering face; (ii) a copper backing plate (3); and an intermediate copper alloy sheet (4) sandwiched between the rear face of the sputtering target (1) and the backing plate (3). For example, see the drawing provided on the attached one page "Patent Abstracts of Japan" for JP 01-096374.

In the FINAL Office Action, the intermediate copper alloy sheet (4) disclosed by JP '374 is interpreted as disclosing a "Cu based alloy sputtering target composition". Applicant respectfully disagrees with this interpretation. The intermediate copper alloy sheet (4) is embedded between the rear of the copper sputtering target (1) and the copper backing plate (3) and is clearly not a sputtering target or a material that is deposited by sputtering deposition. Rather, the intermediate copper alloy sheet (4) is embedded within the assembly (which is secured together via an annular mounting fixture (2)) solely for the purpose of facilitating removal of a spent sputtering target (1) from the backing plate (3) so that the backing plate (3) can be reused with a new sputtering target (1).

Accordingly, one of ordinary skill in the art is taught by JP '374 that by sandwiching a material having a composition of copper with 100 to 3000wtppm in total of at least one or more of Zn, In, Mn, Sb, Be, Ca, Cr, Te, Y, Nb, Mo, Ta and Sn between a copper sputtering target and a copper backing plate, the diffusion of material during the course of a sputtering operation between the confronting faces of the intermediate copper alloy sheet (4) and the copper backing plate (3) can be prevented. Thus, "thermal adhesion" between the alloy sheet and backing plate is prevented. In this way, the copper sputtering target (1) can be readily separated from the

copper backing plate to facilitate replacing a spent copper sputtering target (1) with a new copper sputtering target (1).

Therefore, it should be clear that JP '374 only discloses a copper sputtering target (1), not a copper alloy sputtering target. The composition asserted as being a "**sputtering target** composition" in the FINAL Office Action is not a sputtering target. Rather, the copper alloy sheet (4) is an intermediate layer that is located between the sputtering target and backing plate to enable ready separation of a spent sputtering target from a backing plate. This is the only teaching that one of ordinary skill in the art is provided by JP '374.

(ii) The Disclosure Provided by JP 01-180976 A

JP '976 provides a similar disclosure relative to that of JP '374 discussed above in detail. In JP '976, the copper alloy including 100 to 3000wtppm in total of at least one or more of Zn, In, Mn, Sb, Be, Ca, Cr, Te, Y, Nb, Mo, Ta and Sn is used as the backing plate. In this case, the intermediate layer is referred to as a "Cu substrate". The intermediate Cu substrate is not thermally adhered to the copper alloy backing plate during the course of sputtering for the same reasons discussed above with respect to JP '374. JP '976 states that the copper alloy backing plate produces a significant cooling effect, has a high recrystallization temperature, and prevents thermal press bonding to the Cu substrate during use.

In the FINAL Office Action, the copper alloy backing plate of JP '976 is interpreted as disclosing a "Cu based alloy **sputtering target** composition". Applicant respectfully disagrees with this interpretation. The copper alloy backing plate is secured (via an annular mounting fixture) to an intermediate copper substrate opposite to a sputtering target which is bonded to an opposite side of the intermediate copper substrate. The copper alloy backing plate is clearly not

a sputtering target or a material that is deposited by sputtering deposition. Rather, the backing plate is located well behind the sputtering target in the assembly, and the disclosed composition is used for the purpose of facilitating removal of a spent sputtering target/copper substrate from the backing plate so that the backing plate can be reused with a new sputtering target/copper substrate.

Accordingly, one of ordinary skill in the art is taught by JP '976 to use a material having a composition of copper with 100 to 3000wtppm in total of at least one or more of Zn, In, Mn, Sb, Be, Ca, Cr, Te, Y, Nb, Mo, Ta and Sn as a backing plate that is assembled adjacent to a copper substrate. In this way, diffusion of material during the course of a sputtering operation between the intermediate copper substrate and the copper alloy backing plate can be prevented. Thus, "thermal adhesion" between the copper alloy backing plate and copper substrate (to which a sputtering target is attached) is prevented. In this way, the sputtering target and copper substrate can be readily separated from the copper alloy backing plate to facilitate replacing a spent sputtering target with a new sputtering target on the existing copper alloy backing plate.

Therefore, it should be clear that the composition disclosed by JP '976 asserted as being a "sputtering target composition" in the FINAL Office Action is not a sputtering target. Rather, the copper alloy composition is used as a backing plate that can be readily separated from a copper substrate to which a sputtering target is bonded. This is the only teaching that one of ordinary skill in the art is provided by JP '976.

(iii) The Present Invention

The present invention is directed to a copper alloy sputtering target for use during a sputtering operation to deposit material from the erosion face of the sputtering target onto an

opposed substrate to form a thin film "seed layer" in a wiring groove on which copper wiring of a semiconductor can be subsequently plated and grown by electrolytic copper plating techniques.

As discussed in the present application, a barrier film of TaN or the liked is formed in a wiring groove on an insulating film in order to prevent diffusion of copper to the interlayer insulating film. Subsequently, a thin film copper seed layer is formed on this barrier film via a sputtering process. Thereafter, copper wiring is formed on the seed layer within the wiring groove by an electrolytic copper plating process. Such a plating process requires energization, thus the seed layer is required for use in turning on the electric current to enable growth of the electrolytic copper plated wiring. Accordingly, a seed layer is an essential layer for forming copper wiring via the electrolytic copper plating method.

The role of the aluminum content in the sputtering target of the present invention is to provide a coagulation prevention effect.

(iv) Reasons for Patentability

The claims of the present application are directed to a sputtering target for forming thin films by sputtering deposition. This is a structural limitation as a sputtering target is different from a backing plate or an intermediate layer. The claims of the present invention do not read on a backing plate or an intermediate layer.

Further, the claims of the present invention require a specified amount of aluminum which the cited references fail to disclose or obviate.

Still further, one of ordinary skill in the art is taught nothing by the cited references with respect to a composition that can be used to form a seed layer of semiconductor wiring and that must be able to prevent coagulation. (For a detailed discussion concerning the problem of

coagulation, see page 1, line 30, to page 2, line 9, of the present application, as filed.) Rather, the sole purpose of the additive elements in the copper alloy of JP '374 and JP '976 is to enable ready separation of an intermediate layer or substrate from a backing plate by preventing diffusion and thermal adhesion therebetween that would otherwise develop during the course of a sputtering operation.

Since the additive elements of JP '374 and JP '976 are for the purpose of aiding separation of a backing plate and intermediate layer, the operation and effect of the additive elements are entirely different to that required by the Al in the sputtering target of the present invention. The effect of the additive element (Al) in the present invention is to inhibit coagulation and improve oxygen resistance of the copper plating on a seed layer formed by the sputtering target. Applicant respectfully submits that since there is no common sense association between the desired effects of the additive elements, it would not be obvious to one of ordinary skill in the art to produce a sputtering target according to the present invention based merely on the teachings by JP '374 and JP '976 of backing plates and intermediate layers that can be readily separated.

Accordingly, Applicant respectfully submits that there is no motivation or common sense reason for one of ordinary skill in the art to use the composition disclosed by JP '374 and JP '976 as a sputtering target or for altering the composition with a specified amount of Al content. Rather, the specific content of additive elements of the sputtering target of the present invention is a unique discovery by the present inventor and could not have been conceived based on the disclosures of JP '374 and JP '976.

For all the reasons stated above, Applicant respectfully submits that the sputtering target required by claims 1, 16-25, 35-37 and 39-41 would not have been obvious to one of ordinary

skill in the art based on the teachings of JP '374 or JP '976. Applicant respectfully submits that the claims of the present application are patentable over JP '374 or JP '976 and respectfully requests reconsideration and removal of the rejection.

B. *In the FINAL Office Action dated January 23, 2009, claims 26, 38 and 42 are rejected under §103(a) as being obvious over JP 01-096374 A or JP 01-180976 A in view of U.S. Patent No. 6,113,761 issued to Kardokus et al.*

JP 01-096374 A or JP 01-180976 A and their deficiencies relative to the claims, as amended, of the present application are discussed above in detail. The Kardokus et al. patent fails to overcome any of these deficiencies. Accordingly, for the same reasons discussed above, Applicant respectfully submits that claims 26, 38 and 42 of the present application are not obvious and are patentable over JP 01-096374 A or JP 01-180976 A in view of the Kardokus et al. patent.

III. Conclusion

In view of the above amendments and remarks, Applicant respectfully submits that the rejection has been overcome and that the present application is in condition for allowance. Thus, a favorable action on the merits is therefore requested.

Please charge any deficiency or credit any overpayment for entering this Amendment to our deposit account no. 08-3040.

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PATENT ABSTRACTS OF JAPAN

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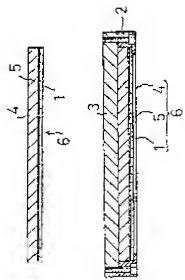
(54) CLAD TARGET MATERIAL FOR SPUTTERING

(57)Abstract:

PURPOSE: To prevent a clad target from thermally adhering to a backing plate by cladding a high-purity copper sheet containing trace amounts of specific elements with a sputtering target material.

CONSTITUTION: A Cu sheet 4 having ≥99.7% purity and containing 100W3,000wt. ppm, in total, of at least one or more elements among Zn, In, Mn, Sb, Be, Ca, Cr, Te, Y, Nb, Mo, Ta, and Sn is joined to a sputtering target material 1 by a metal bonding agent 5 made of In so as to be formed into a clad target material 6. The Cu sheet 4 of this clad target material 6 is attached to a backing plate 3 consisting of a Cu sheet with high thermal conductivity by means of an annular mounting fixture 2. By this method, the diffusion of the Cu sheet 4 of the clad target 6 into the backing plate 3 composed of Cu sheet in the course of sputtering and the resulting thermal adhesion between them can be prevented, by which the separation of the clad target 6 from the backing plate 3 is facilitated and, as a result, the exchanging operation of the target 6 can be facilitated.



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(54) BACKING PLATE FOR SPUTTERING

(57)Abstract:

PURPOSE: To obtain a backing plate for sputtering capable of being easily detached from a Cu substrate after use without causing thermal press bonding to the substrate during use by adding a specified amt. of Zn, In, Mn, Sb, etc., to high purity Cu.

CONSTITUTION: A backing plate for sputtering by which a high purity Cu substrate having an adhered target material is held in a contact state is obtd. by adding 100W3,000wt.ppm, in total, of one or more among Zn, In, Mn, Sb, Be, Ca, Cr, Te, Y, Nb, Mo, Ta and Sn to Cu of ≥99.7% purity. The backing plate produces a significant cooling effect owing to its satisfactory heat conductivity and the diffusion of Cu is inhibited by the added elements. The plate has a high recrystallization temp. and prevents thermal press bonding to the Cu substrate during use.